PROLONGED LIFE OF INVERTEBRATES: NOTES ON THE AGE AND HABITS OF THE AMERICAN TARANTULA.

BY HENRY C. MCCOOK, D. D.

Until very lately little has been known concerning the possibilities of prolonged life among the lower orders of animals. It is well known that the waste of life is very great in the natural conditions surrounding most inferior creatures, so that the immense fecundity of insects and araneads, for example, is abundantly checked. I have counted over eleven hundred eggs and young spiders in the single egg-cocoon of the Bank Argiope, *Argiope riparia*, yet one of the rarest finds for an observer is a very young individual of this common species. In efforts to breed spiders from the cocoon, I have at various times seen colonies numbering one hundred or more dispersed from the maternal egg nest to the surrounding foliage, of which during the year not a single survivor could be traced.

Bee keepers are well aware of the great mortality among working bees, caused not only by disease and accidents, but especially by those enemies which prey upon them. Ants are quite as much, perhaps even more exposed to loss from accidents, the exigencies of weather and the appetites of various insectivorous animals. There is, therefore, abundant occasion for the seemingly exhaustless fertility of the queen mothers of formicaries. These queens probably have a longer life than the workers. They are larger in size and apparently organized for more vigorous resistance of the influences which work for their destruction. Moreover, the instinct of the workers has provided a system of preservation by surrounding the queen with a guard of attendants which never leave her unprotected, which care for all her wants, and vigilantly separate her by a regular system of seclusion within the portals of the formicary, from many influences which would prove hostile to health and fatal to life.

I. Sir John Lubbock's Aged Ant Queen.

How long an ant queen may live in entirely natural habitat is unknown, and perhaps cannot be determined. But recently through the patience and ingenuity of Sir John Lubbock, we have learned that under artificial protection both workers and queens of certain species may attain a great age. Nearly six years ago I had the privilege of visiting this distinguished naturalist at his country seat, High Elms, Kent, and examining, under his personal direction, his

artificial formicaries and the mode in which they are preserved. At that time I saw a queen of the Fuscous ant, *Formica fusca*, which was nearly eight years old. During the past summer (1887) I again visited Sir John at his house in London, and on inquiry after the aged queen, which I supposed to be still living, was informed that it had died the day before, having at the time reached the wonderful age of more than thirteen years. I was permitted to see this venerable queen as she lay in death on the floor of one of the wide chambers which the workers had excavated in the soil compacted between glass plates that bounded their formicary. She was still attended by the circle of "courtiers," which, according to my published observations,[1] are in the habit of waiting continually upon ant queens. Some of these attendants I saw licking the dead queen, or touching her with their antennæ and making other demonstrations as though soliciting her attention or desiring to wake her out of sleep. "They do not appear to have discovered that she is really dead," remarked Sir John. And so indeed it seemed. It was certainly a touching sight to witness these faithful attendants surrounding the dead body of one who had so long presided over the maternal destinies of the colony, and seeking by their caresses to evoke the attention which never again could respond to their solicitations.[2]

Such experiments as the above clearly indicate that artificial environment may have a beneficial influence upon insects as well as domestic animals, and that the interference of human intelligence may be a preservative factor as well as a destructive one in the lives of even our most lowly organized fellow creatures.

While awaiting with great interest the details of the life history of this venerable sovereign of the emmet world, which Sir John Lubbock will doubtless publish, I venture to note the simple fact of her prolonged life as an introduction to some facts in the same line of observation, but relating to a spider.

II. Long Life of a Spider.

Early in the year 1872, I received from Dr. Joseph Leidy a specimen of our common American species of the Theraphosoidæ, first described and known as *Mygale Hentzii*, and popularly called the tarantula. This animal was given to Prof. Leidy by a young friend and turned over to me with the request that at its death the specimen

1 "Honey and Occident Ants" Chap. iv, p. 41 and Pl. VI, fig. 29.

2 See note at end of paper.

should be returned to him.[1] As the individual seemed to be in good health, I preserved its life in order to gain information as to its habits and vital endurance. It was first placed in a large glass fish globe on a bed of earth, where it was kept for more than a year. It was then transferred to a wooden box made with glazed slides and a sliding glass door at the top, the whole being eighteen inches long, twelve inches wide and ten high. One end was filled with dry soil which was slightly compacted and heaped up; the other end was sparsely covered with earth. There was thus presented a bit of level space for a water trough, for exercise etc., and full opportunity for the spider to burrow should it be inclined to its natural tastes. The animal was kept in this box until mid-summer of the present year. I last saw it early in July, just prior to my departure for England. On June 22nd, 1887, I made this note: "This spider which has been kept ever since 1882 is today in good health. It is on the outside of the earth moundlet in its box looking hearty after the winter's fast. It has had nothing to eat since October last—at least eight months, but has had water freely. Some flies have been put into it lately, but I do not know that they have been eaten." The spider was then left in the care of my friend, Professor Fronani, who for several summers, while at work in the Library hall of the Academy, had kindly cared for it during my absence, giving it water and feeding it with insects, particularly grass-hoppers, or locusts.

On my return from abroad I was met at the Academy by the intelligence that my tarantula was dead. It had descended into the burrow, which for several years it had maintained close to the side of the box, about the end of July, and since then had not come up. Looking into the box I could see against the glass what appeared to be the fragments of the moulted skin on one side of the cavity, and on the other side the outlines of the creature's dead body. Prof. Leidy, from whom the animal had been received, and after whom I had named it, (a name being convenient for familiar reference,) happened to be in the Library hall at the time I took up the remains of the spider from its burrow. We found the carcass already partly decomposed and being preyed upon by dermestid larvae. Close beside it were the fragments of its cast skin. It had evidently died shortly after moulting.

[1] It was captured about the beginning of April 1882, at Hill's Ferry, Stanislaus Co., California, was kept in a bottle without food for two weeks, then sent to Prof. G. E. H. Weaver at Media, then a student in Swarthmore College. Mr. Weaver fed it on beefsteak which it took readily.

Reckoning its death as having occurred at the close of July 1887, the spider was five years and three months in my possession. I have not sufficient data to estimate accurately the rapidity of growth in this species, but judging from such facts and indications as I have observed, I do not hesitate to reckon the animal to have been from eighteen months to two years old when I received it from Dr. Leidy. At the period of its death, therefore, it must have been at least seven years old, and may have been eight. It has thus attained the distinction of having reached the greatest age of any spider known to science. How long this species and members of the Theraphosoidæ generally live in their natural habitat is of course unknown. I have no doubt that they live much longer than spiders of the other great sections or groups, but am inclined to think that it is not usual for them to reach such on age as my tarantula "Leidy." In its case, as in that of Sir John Lubbock's queen ant, human protection probably aided to prolong life.

Such observations as have heretofore been made upon the age of spiders fall in with the general indications as to their vital endurance made by the prolonged age of this tarantula. Blackwall, the veteran British araneologist, kept spiders of the species *Tegenaria domestica* and *T. civilis* to the age of four years.[1] Moggridge made a calculation upon the age of trap-door spiders based upon the average growth in the nests of the young, for he established the fact which has subsequently been confirmed that the young spider instead of abandoning its nest enlarges it with its growth. The conclusion of this calculation was that it took at least four years to produce a full size trap-door nest, and of consequence the architect must be at least that old.[2] The most recent information upon this point is given by Mr. Fredrick Enock in a paper published two years ago.[3] This observer in an extended and interesting communication upon the habits of the British Atypus speaks of one individual which he had in his possession over three years, and which, judging from its size when first captured, he puts at the age of six years. Other examples which had been under observation for more than two years were well grown when first transferred to his artificial colony,

[1] "Spiders of Great Britian and Ireland." p. 8.

[2] Moggridge. "Harvesting Ants and Trap-door Spiders." p. 127.

[3] "The Life-History of *Atypus piceus*, Sulz." Transactions Entomological Society of London. 1885. p. 416.

and at the date of his paper, June 1885, were still in good health. He ventures the inference that *Atypus* is about four years in reaching maturity, then retains her young for eighteen months under her care before turning them out to shift for themselves, and after that lives in vigorous health for a period which he believes may sometimes reach the advanced age of ten years.

I may add here, as in the same line of research, that Dr. George H. Horn a distinguished authority in the Coleoptera, has called my attention to the fact that a female of *Cybister roeselii* was preserved for eight years of continuous life by Dr. David Sharp.

As has been stated, my tarantula died in the act of or in consequence of casting its skin. It has usually been accepted as a fact that the final moult of spiders is made just before the attainment of maturity. Unfortunately the decayed condition of the carcass does not permit me to determine the question in the case of this particular individual. But these interesting queries are suggested: did the artificial conditions of the spider's life so influence its organism as to retard the functions that result in the act of moulting? Are we therefore to consider this final moult, accomplished at the age of seven years or thereabouts, to have been abnormal as to the time of its occurrence? Or, may we infer that this represents the normal periodicity of moulting and of consequence that the mature spiders of this family, which are so frequently taken in various parts of the earth, are all of them as old as the one whose history I have been noting?

III. Habits of the American Tarantula.

1. *Moulting and its dangers.*—During its confinement "Leidy" shed its skin several times. The first moult occurred sometime in August 1882. I had been absent on my usual summer vacation and returning August 31st, saw the animal lying on the soil about the middle of its glass nest with its feet gathered together looking dull, gray and faded out—apparently dead. I shook the globe. No response was made by any action, and as I was at the time in a great hurry, I left without more careful observation, concluding that the spider was dead. I was not able to visit it again until the fifth day of September following. I threw off the cover of the globe and put my hand in to take out the dead body, which lay apparently in the same position, in order to preserve it in alcohol. As I touched it the animal leaped to its feet, and as I hastily withdrew my hand thankful for the danger which I had escaped, for the creature bears

a poisonous fang, it presented itself quite changed in appearance. The body was of a fresh, bright color, the cophal thorax a clean whitish gray, the head and fangs dark brown. The abdomen was black with brown hairs covering it. The legs were black with yellowish brown hairs and spines. I at once understood that the spider when first seen was in the torpid condition which usually immediately precedes the act of moulting. In the interval between my visits it had cast off its skin which I found lying in a tolerably complete condition on one side of the glass. The spinnerets and abdomen were entirely unbroken, the spider having evidently escaped therefrom by pulling its abdomen forward. (Fig. 1).

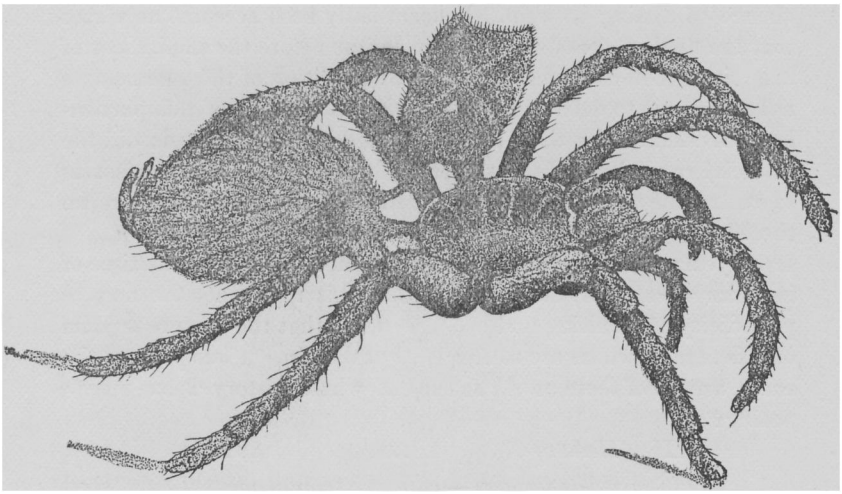

Fig. 1. Moult of Tarantula showing mode of Escape.

The dorsum of the cephalthorax was attached to the upper part of the abdomen, and the sternum to the lower part, showing that the fore part of the skin had cracked around the median line of the cephalthorax. The feet and legs were attached to the sternum, and on one side the casts were entirely complete.

The death of this tarantula is another example of a fact which I have previously observed, that the act of moulting is frequently attended by dangers of one kind or another to spiders. It is common to find specimens without one or more limbs, also with distorted and abbreviated limbs. I have frequently found males lacking several legs. The theory commonly adopted is that in most of these cases the loss has resulted from conflicts, perhaps among rival lovers in

attendance upon the same female. Something of loss may be attributed to this cause, but I am satisfied that in a much larger degree losses and malformations are due to the accidents of moulting. One example I may cite, the loss of two limbs experienced by a large tarantula which I had kept under observation; for during the last few years I have had a number of these large creatures in artificial nests. This spider lay upon its back during part and on its side during the remainder of the time of moulting. The skin was cast by a succession of movements of the body or parts of the body recurring at regular intervals reminding one of labor pains among mammals. For some reason two of the legs refused to separate from the skin and after a prolonged struggle they were broken off at the coxae, and remained within the moult. One foot of another leg shared the same fate. This moult occurred in the spring; during the latter aprt of August of the same year the spider again moulted. The moult was a perfect cast of the animal, the skin, spines, claws and the most delicate hairs all showing, and their corresponding originals appeared bright and clean upon the spider. When the cast off skin was removed the dissevered members were lacking thereon, but on the spider itself new limbs had appeared, perfect in shape but smaller than the corresponding ones on the opposite side of the body. The dissevered foot was also restored. The rudimentary legs had evidently been folded up within the coxae, and appeared at once after the moult, rapidly filling out in a manner perhaps somewhat analogous to the expansion of wings in insects after emerging.[1]

It is possible that my tarantula "Leidy" was too much exhausted by long previous fasting to endure the severe strain which evidently is laid upon the organism in the act of moulting, although judging from the disjecta membra of the skin recovered from the burrow it had succeeded in casting them all off without any mutilation. The Spring of 1887 was a backward one, and I experienced great difficulty in procuring insects for food from the immediate neighborhood. The annual supply of grass-hoppers and locusts upon which I had relied came very late. Perhaps had the spider been strengthened by a few week's generous feeding previous to its last moult, it might still have been alive.

2. *How to keep spiders alive.*—I may say here that my experience in keeping other large spiders is that there is quite as much danger from over-feeding as under-feeding. I have found the best success

[1] See Proceedings Academy of Natural Sciences Philadelphia, 1883. p. 196.

by giving a generous supply of living food during the summer and early autumn, and withholding food almost entirely during the remainder of the year. I was particular, however, to keep a vessel continually supplied with fresh water within the box. Spiders require water quite as much as other animals, and failure to keep them supplied will be fatal to health and life. I have sometimes succeeded in tempting a tarantula to suck the juice of a bit of raw beef, but the only food that can be relied upon is living insects; and the spiders appear to be able to lay up within the four or five months of summer enough nourishment, in connection with a free supply of water, to last them during the entire year. They do not become torpid in the winter time, it should be said, but remain active throughout the entire season, provided they are kept in a room heated to a moderate temperature. If exposed to severe cold they are soon benumbed, but quickly recover when again brought into a warm atmosphere.

When the spider was disposed to feed, an insect was seized with the fore legs, palps and mandibles, which rapidly conveyed it to the mouth against which it was held by the palps which also turned the carcass as the spider had occasion, aided by the mandibles, the latter crushing the victim meanwhile. (Fig. 2). On one occasion

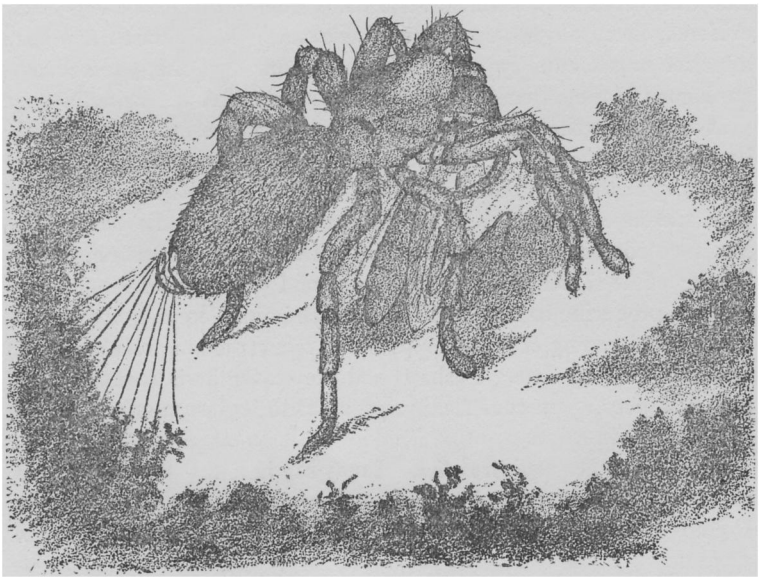

Fig. 2. Tarantula feeding upon a locust.—The white Silken rug shown.

while in the act of feeding upon a locust a second individual approcached near enough to be seized It was put upon the ground where it was held down until the spider, moving slowly around, overspun and swathed it, evidently reserving it for future use.

3. *Spinning and Spinning work.*—The central space of the little mound in the box was usually kept covered with a white sheeted web, suggesting the idea of a rug, upon which the creature loved to rest. If this were removed or covered over with dirt it was restored by the spider in a little while. In the act of spinning, the long inferior spinnerets were curved upward, and from the spinning tubes along the exterior part gave out numerous fine threads. These were attached to the ground by the downward motion of the spinnerets. The abdomen was lifted up, the threads were thus drawn out, the downward motion repeated, and simultaneously the end of the abdomen with the spinnerets attached received a lateral motion which caused the threads to be spread over the surface of the ground. At the same time the animal slowly moved its whole body around as upon a pivot, thus dispersing the silk over a circular patch of the surface, about equal in diameter to twice the length of its body, or to the spread of its legs. (See Fig. 2). At times a web much more open in texture would be found spread more or less freely over nearly the whole surface of the soil.

It has been said that when the white central rug became soiled by dirt or food debris it was soon over spread with a clean layer. In course of time the top of the mound in "Leidy's" box became thus covered with a thick mass of intermingled silk and clay which I easily removed and have preserved intact. The piece represents nearly the compass of the central rug, and is a curious compound of intermingled soil and silk. It is a fact that the remarkable hinged door which the trap-door spider attaches to her burrow is made up of alternate layers of silk and soil. If one were inclined to speculation, or to a "scientific use of the imagination," he might raise the inquiry: may not the the trap-doors spiders have found in some such accidentally formed texture the original suggestion of her mud-and-silk door? On the other hand, one might also wonder why the tarantula and, in fact, other spiders with equal facilities of like nature have not developed some trace of the same habit?

Two locusts were once placed in the box at a part where the threads were numerous, one of which was soon entangled in the spinning work and began to struggle for freedom. Tarantula was

on the mound about ten inches distant and moved slowly towards the insect, creeping, crouching, evidently directed by the agitated web. It was very tardy in its approach and my attention was unavoidably diverted, but shortly afterward I saw the spider devouring the locust. The question was raised, does the tarantula in natural site take its prey in this way, by lines spread before its den or elsewhere upon the surface of the ground? Mr. Bates appears to have the opinion that the web of the large Brazilian tarantula is used to capture prey; at least, he speaks of birds entangled therein and fed upon by the spider.[1]

The thick texture of the sheeted web is produced by the act of beating downward with the long spinnerets, repeated motions of which up and down make little loops which thicken over the surface and are beaten down and then smoothed over by the spinnerets. (Fig. 3.) The action does not greatly differ from that of all other

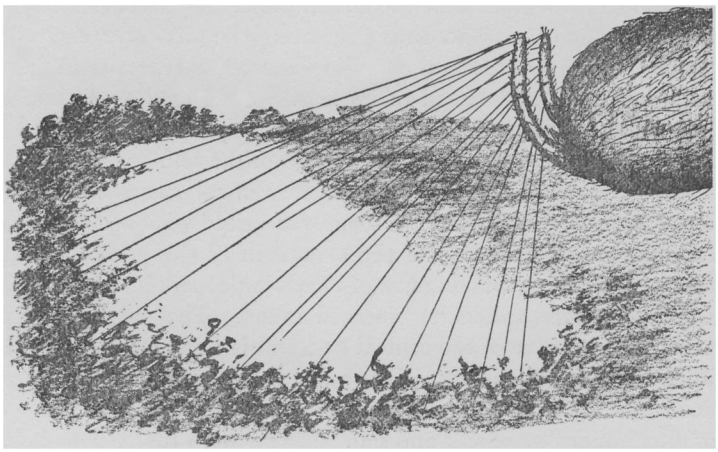

Fig. 3. Spinning the rug; use of the long spinnerets.

spiders while engaged upon similar spinning work. In the act of spinning, tarantula frequently reaches one hind claw to the spinnerets and makes a series of rapid strokes, then stretches out the foot as though carrying the thread with it. It would appear to be intended thus to draw out the silk from the spinning tubes, but the motion was so rapid that I never could exactly make out its full purpose or determine whether it might not be a mode of clearing

[1] The Naturalist on the Amazon, ii, p. 58.

out or rearranging the spinning tubes and surrounding spines; in other words, the adjustment of the spinning machinery.

4. *Character of the Nest and mode of burrowing.*—The opinion prevails largely that the tarantula, *Mygale Hentzii*, makes a trap-door nest, and it has not been an uncommon thing for me to meet tourists who had purchased in California specimens of trap-door nests, and at the same time a specimen of the large tarantula which the sellers claimed had made it.[1]

I am satisfied by my long continued observations of these creatures in confinement, as well as by authentic reports from various persons, that they make no trap-door, and that their only nest is a burrow in the ground. Dr. J. Rowland, of Media, Pa., who has several times visited Los Angelos, informs me that the tarantula is there found in holes covered with a slight web. A little mound of fresh earth is thrown up around the surface edge of the hole which is merely covered over by a delicate web. There is no trap-door to this den, which is a burrow about an inch and a quarter in diameter extending downward from ten to twenty inches in depth. The boys bring the spiders up by pouring water down the holes. The great creatures burst out of the open gate, spread their long legs and hurry away, and are then easily captured. According to Mr. G. W. Holstein who has frequently observed them in Texas they live in holes about one and an eighth inch in diameter which appear to have a white silky lining and are generally found in sandy soil. One burrow dug up by his brother was ten inches deep; was destitute of a lining, but at the bottom there appeared some sort of a nest. When disturbed the creatures run into holes formed by the weathering out of fossils &c. At Los Angelos the animals are found at times occupying gopher holes.

[1] Professor Spencer F. Baird, the late distinguished and lamented Secretary of the Smithsonian Institution, entertained this opinion, and when I once questioned it, thought he had specimens in the museum at Washington that would prove it. He subsequently wrote me: "I did not find in any of the California nests any remains of spiders at all but we have two from Jamaica which still have large hairy spiders in them. These nests are much more slender than those from California. I shall be pleased to show them to you whenever you visit Washington. I cannot send them as they are too fragile for transmission." I have not yet had the opportunity of examining these specimens, but think that they will be found to belong to the genus *Nemesia* or *Cteniza*, and are not true tarantulas.

Mr. Bates describes spiders of this family (*Mygale Blondii* and *M. avicularia*) as inhabiting broad tubular galleries smoothly lined with silken webs. The galleries are two inches in diameter and run in a slanting direction about two feet.[1] Again he speaks of them as spreading a thick web beneath a deep crevice in trees, and having their cells under stones.[2] Once more in alluding to their diversified habits he says that some species construct among the tiles or thatch of houses dens of closely woven web which in texture very much resembles fine muslin. From these domiciles they invade the house apartments. Others, according to Mr. Bates build similar nests in trees.[3] I believe that it will be found that the creatures that burrow in the earth are identical with those which spread sheeted webs among the trees. Numbers of tarantulas come to our port (Philadelphia) in fruit vessels, and are often found in the great pendants of bananas, to which they had no doubt resorted as a convenient field for capturing prey, and were themselves captured and shipped hidden away among the clusters of fruit.

In the case of the spider "Leidy" the only effort made at nest building was a rude burrow which was excavated against one side of the box and which in the course of time was extended downward to the bottom of the box and laterally along the bottom either way, thus forming an irregular cavity. Into this it frequently descended, dividing its time between the cave and the outside surface. This burrow was entirely destitute of a silken lining, although occasionally the opening at the surface would be overspun with a thin sheet of spinning work. I have seen the same habit in other individuals of the species kept in confinement. The only attempt at a nest ever observed by me has been this burrow, with an occasional sheeted closure, and rarely a slight silken lining of the interior of the burrow. I believe, therefore, that the popular theory that the tarantula makes a trap-door is without foundation in fact, and that its ordinary habitat is a plain burrow like that made by most Lycosids.

The mode of making the burrow was well observed by me at various times. In the act of digging, the spider first uses the two leg-like palps, the digital brushes of which are well adapted for that

[1] Bates "The Naturalist on the Amazon" Vol. ii, p. 58.

[2] id. Vol. i, p. 161.

[3] id. Vol. i, p. 106.

service. Then the two front feet are brought into play to gather up the loose pellets of soil and scrape them into a ball. The first and

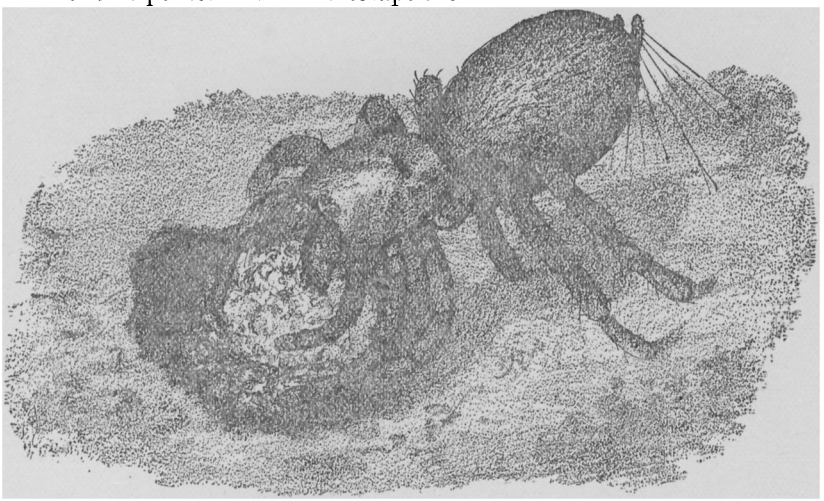

Fig. 4. Tarantula digging up and gathering a ball of earth to carry away.

second pairs of legs now close up around and under the balled mass, thus compressing it inside the mandibles. (Fig. 4.) When the pellets have thus been gathered and squeezed into a mass, they are held within the extended mandibles, the palps in the meantime girdling them at the side and beneath, and so are carried away from the burrow to the dumping ground. (Fig. 5.)

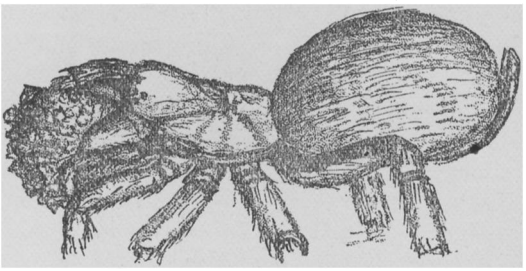

Fig. 5. Mode of carrying excavated soil.

I never observed any scratching and scraping the dirt backward in the fashion of a dog digging in a rabbit burrow, which is also the action of ants, bees and wasps when excavating the earth. Always the pellets were deliberately loosened as I have indicated, squeezed together into a ball and carried off. During the act of digging, and indeed quite habitually during all actions such as eating etc., the

spider kept her spinnerets curved over the end of the abdomen with a diverging ray of threads issuing therefrom and attached to the surface beneath.

5. *Toilet Habits.*—After digging, the palps were used to wipe off the fore parts of the body, very much as a cat uses her paw for a like purpose. The fore legs were placed against the palps and were cleansed by rubbing the two together. The toilet was also accomplished by overlapping one leg with the other, the second leg over the third, for example, and then rubbing the two as if a man were to scratch his leg by drawing the inner surface of one along the front surface of the other. The first leg was thus rubbed against the second, of course being pressed down upon it meanwhile. The palp too was thrown back to the first leg which it brushed off in the same manner. After digging in its burrow, "Leidy" was always quite sure to cleanse its person, and by reason of its size the use of its palps in wiping off the fore part of its body presented a most amusing likeness to the familiar action of pussy when washing off her face with her paws.

6. *The character of the egg cocoon.*—A large female tarantula was sent to me from the West Indies, and arrived at the Academy during a prolonged absence. She died before my return and was preserved

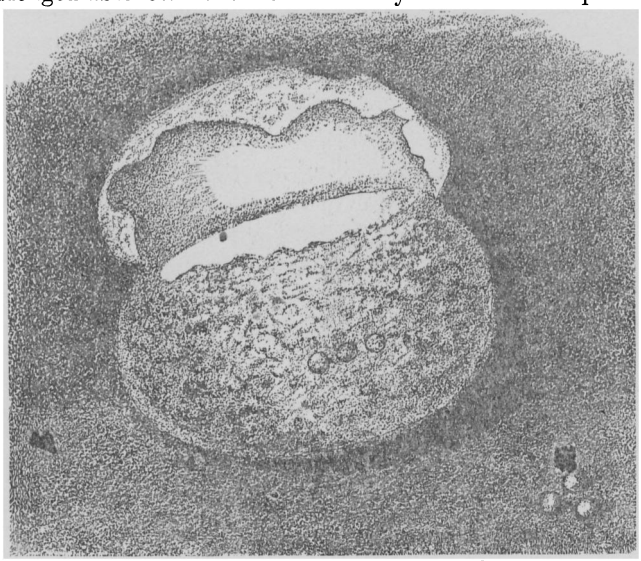

Fig. 6. Cocoon and eggs of Tarantula.

in spirits; but afforded me an opportunity, which I had long desired,

of determining the egg cocoon made by this family, the Theraphosoidæ. While cleaning out the box in which she had been sent I observed a piece of spinning work within, which proved to be an abandoned cocoon. It was much flattened, but when inflated showed a hollow spheroid composed of thick silken cloth, somewhat soiled on the outside, but within clean and white. It measured two inches along the longer axis and 1¼ inch along the shorter one. It was empty of young, whose first moults, however, were within the cocoon, as were also a few unhatched eggs which are yellowish spheres, two millimeters in diameter. Three small openings in the case showed where the spiderlings had escaped. Both cocoon and eggs are shown natural size in the accompanying figure. (Fig. 6).

The interior of this cocoon was without any flossy lining or padding, resembling thus the egg sacs of the Lycosoidæ generally. A curious flap overlapped the cocoon at one side, whose use I could not conjecture, unless it may have served to attach the object to the mother's body; or, perhaps, it was simply a remnant of material which had remained after the eggs were rolled up within the silken rug upon which they are probably deposited after the manner which I have shown to exist in the genus *Lycosa*.[1]

The janitor who received the box containing this spider and placed it in my room was at the time new in his position and did not understand the importance of observing all the particulars in the habits of living creatures sent to the Academy. He therefore failed to make any notes, but told me when questioned that he believed that the cocoon was attached to the lower part of the body of the spider when it arrived. No doubt this is a correct observation, and we may assume with some degree of certainty that the large egg sac of the Theraphosids is carried by the mother lashed to the spinnerets at the apex of the abdomen, precisely as in the case of Lycosids, whose well known habit is familiar to every frequenter of our fields.

This cocoon is exhibited in my collection of Aranead architecture deposited in the Academy, and is the only one, so far as I have been able to learn, exhibited in any similar institution. Termeyer speaks of cocoons of the Mygalidæ of South America ("*Aranea avicularia*") even greater than the above. They are three inches long by one

[1] See Proceedings Academy Natural Sciences of Philadelphia, 1884. Page 138, my note on "How Lycosa Fabricates Her Round Cocoon".

wide, and are placed in the fissures on the trunks of trees. They contain thousands of eggs. This extraordinary size of the cocoon had made the inhabitants who do not observe carefully, imagine that this spider would take the cocoon of "the bombice moth, del Guyavo (*Janus*, Linn.)" and having destroyed or eaten the chrysalis would place her own eggs therein, and then artificially close the hole by which she had penetrated it. One of these cocoons weighs as much as six cocoons of the silk worm when they are washed, and as much as three or four after having been washed.[1]

Madam Merian, who first recorded a report that the Theraphosoidæ prey upon small birds, must have observed the cocoon of these spiders, as it seems to me. She indeed speaks of them as having their domicile in a large round nest resembling the cocoon of a caterpillar, but the plate to which she refers is a fairly accurate figure of a female tarantula with a large oval cocoon attached to her abdomen in the way usual to Lycosids.[2] I have the opinion that the egg cocoon of the spider was mistaken by Madamoiselle Merian or her informants for a "domicile." At all events we may consider that it is fairly well assured that, in her cocooning habits, the female tarantula throughout most or perhaps all species, closely resembles the Lycosoidæ, and the resemblance probably extends to all the Territelariæ. In other words, the Theraphosid cocoon is (1) round or ovoid, (2) is carried about with the mother, attached to her body, or kept under her care, and (3) the young for a period longer or shorter remain with their mother. The affinity between these two great groups of araneads is also marked in their nesting habits; both burrow in the ground a cylindrical tunnel or shaft within which they domicile, sometimes lining it more or less completely with silk.[3]

7. *Attitude at rest and in attack.*—While resting upon its silken rug a favorite position of the tarantula was as follows: On one side the first leg and the last leg were well extended, the feet were lifted a little distance above the ground. The second and third feet were

[1] Communications Essex Institute, Vol. v., 1866—67, p. 61. "Researches and Experiments upon silk from Spiders and upon their reproductions, by Raymond Maria de Termeyer." Translated from the Italian, and revised by Burt G. Wilder.

Desertation sur la Generation et les Transformations des insects de Surinam. Mariae Sibillae Merian. A la Haye, mdccxxvi.; Fig. 18 and explication.

[3] I purpose tracing this resemblance more in detail in a subsequent paper on "Nesting Habits of the American Purseweb Spider, Atypus niger."

placed upon the ground. On the opposite side, the legs rested upon the surface. One of the palps was lifted up; the other touched the earth. Sometimes when slightly alarmed or its attention was attracted by any noise or agitation, all the fore feet, the two pairs on each side, as well as the palps, would be raised from the ground and slightly thrown back. If the alarm or excitement increased the whole fore part of the body would gradually be raised, the legs and palps thrown backward in a curved position, and the mandibles also bent back, slightly separated and ready for striking. In this rampant attitude the body rested upon the two hind pairs of legs which were rather extended, and on the third pair which were slightly bent and pressed firmly against the soil. As they were more or less stiffened and straightened the body would be thrown backward or depressed. This was the position invariably taken by the tarantula when angry, and from this position it would spring forward and strike any object which excited its wrath, or which it wished to destroy.

Having struck out, which was done by bringing down palps, fore paws and fangs together upon the victim, the creature sank back into its rampant position. If so inclined it could rapidly repeat this movement. The whole attitude was an admirable expression of anger and readiness to strike for defence or offence. In the fine muscular exhiliration imparted by the creature's passion, the limbs assumed such graceful curves, and the pose of the body showed so happy a combination of vigor and ease, that the formidable spider really looked beautiful. It could stand in this rampant attitude with motionless rigidity for many minutes.

Among these notes of the general habits of the tarantula I may place the following, also communicated to me by Mr. Holstein. His observation of the tarantulas in Texas convinces him that they are very irritable. They will jump at least ten inches if they are excited thereto by sticks, although they are otherwise not inclined to be troublesome. He has known them to jump almost as high as his horse's knee. In the sandy country along the Colorado River in Texas they are very numerous, and one became so enraged one day as to run up the horse of one of the company as far as the shoulder before it was knocked off. Some Texans say that it is an infallible sign of rain to see these creatures crawling about freely.

I have myself captured them in Texas without difficulty, but was never able to find anything satisfactory as to their field habits

except the fear which they show when the famous wasp popularly called "the tarantula killer," *Pompilus formosus,* happens to be in the neighborhood. The excited haste with which the huge spider hurries off into hiding, when one of these formidable hymenopters is near is a very striking sight.[1]

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[1] The following note was received from the author of the above paper just as the printed pages were going to press, and work thereon has been stopped in order to admit the explanation.—The Editor.

DR. EDWARD J. NOLAN,

Dear Sir:—

I have this morning received a note from Sir John Lubbock dated January 6th, in which he says "My old ant queen is still alive, but I fear a little stiff."

I am not able to explain the discrepancy between this statement and the account given of the apparent death of the same insect in my paper (page 370). It is evident, however, that both Sir John and myself were deceived by what must have been a transient suspension of activity. I saw the ant, and carefully observed it for five minutes or more, and am confident that it had the undoubted appearance of death. Sir John must have been laboring under the same mistake for at least a day.

I have no explanation of the phenomenon which thus deceived one of the most careful observers of emmet habits in England, to say nothing of myself. I await anxiously the explanation, for which I have written, of this apparent "resurrection," but in the meantime am desirous that some statement shall be got into or attached to my paper, to modify in accordance with present facts what I therein say.

If the work has not too far progressed to allow this, will you please see that this note or the substance thereof, is inserted at the end of the paper.

Very truly yours,

HENRY C. MCCOOK.